

Introduction to Databases

Lecture 1

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- 1 Overview of the Course
- 2 Databases
- 3 Benefits of Databases
- 4 The Concurrency Problem

Overview of the Course

- Relational databases
 - Basics
 - Normal forms
 - Triggers
 - Views

Overview of the Course

- Dynamic web pages
 - HTML
 - CSS (briefly)
 - PHP
 - Javascript
 - AJAX (briefly)
 - JQuery
 - XML (briefly)

Project

- Develop a social network application for the web.

Databases

Definition (Database)

A **database (DB)** is a collection of related data.

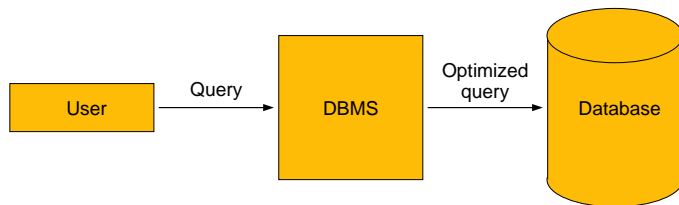
Definition (Database Management System)

A **database management system (DBMS)** is a program that accepts queries into a database and returns responses.

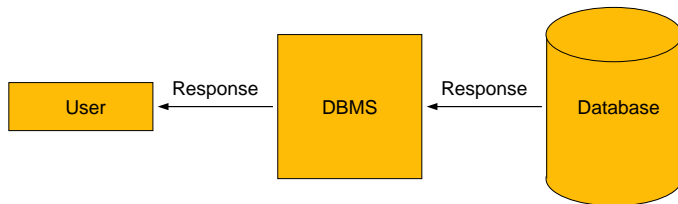
Definition (Query)

A **query** is a request that is sent to a DBMS instructing it to perform an operation on a database. A query may retrieve, insert, delete, or update data in the database.

Databases



Databases



- Characteristics of a DBMS.
 - Limited redundancy
 - Restricted access (privileges and views)
 - Persistent storage
 - Efficiency
 - Backup and recovery
 - Multiple users (concurrency)
 - Data integrity

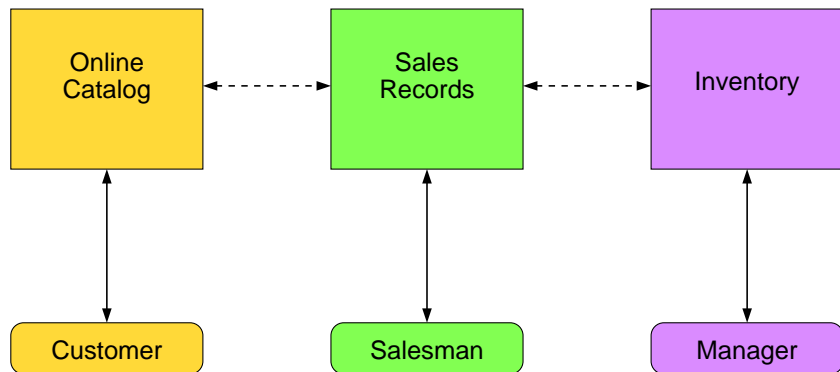
Databases

- As we will see, it can be quite tedious to enter the queries through a command line.
- Often the “user” is actually an application program or a webpage, in which the queries are preprogrammed.
- After our initial study of databases, we will design webpages that will automatically query the underlying database.

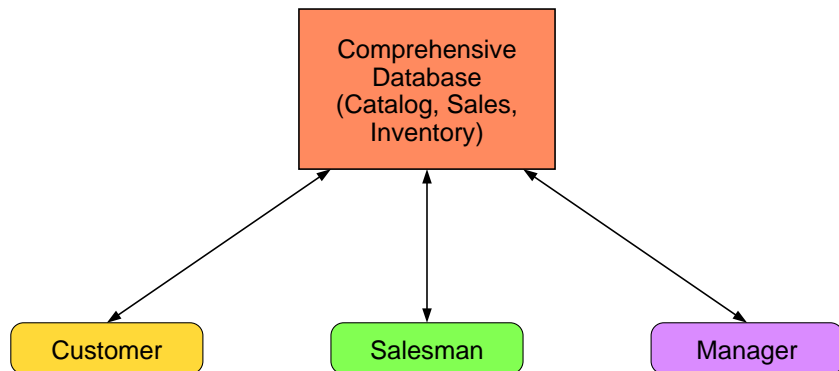
Benefits of Databases

- A few of the benefits of using a database:
 - The user does not need to have knowledge of how the data is stored. He works through a user-friendly interface.
 - Different users can be given different views of the data. Each user may be unaware of the views that other users have.
 - Data can be easily shared among users.

Benefits of Databases



Benefits of Databases



Various Roles

- Roles of various individuals involved.
 - The database administrator (DBA) – Oversees the entire system.
 - The database designer – Designs a database to meet the specs.
 - The user – Queries the database according to his needs.
- At various times in this course, we will be the database designer and the database user.

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- One other person involved is the person who built the DBMS.

Concurrency

- Multiple users accessing the very same data at the very same time leads to the concurrency problem.
- For example, Alice, a customer, requests the price of item #123.
- At the very same time, Bob, an employee, is updating the price of item #123.
- Which price will Alice see?

Concurrency

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- For example, Alice, a customer, requests the price of item #123.
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- Which price will Alice see?
- It depends on who goes first, Alice or Bob.

Concurrency

- More significantly, Alice, an airline employee goes online to select a list of passengers on flight #123. (There are 100 of them.)
- At the very same time, Bob, another airline employee, goes online to change the flight number from #123 to #456.
- Alice selects the first 50 names of passengers on flight #123.
- At that moment, the flight number is changed to #456.
- The last 50 names are not selected because the flight number was no longer #123.
- This type of conflict must be avoided.

Definition (Database)

Online analytical processing (OLAP) involves querying a database to obtain summary data, typical retrievals and aggregation.

- Most database applications fall into one of two categories: OLAP or OLTP.
- A typical OLAP application would be to get the total daily sales from online purchases.
- OLAP is computationally intensive (e.g., summing over millions of records).

Definition (Database)

Online transaction processing (OLTP) involves many small queries, typically insertions.

- A typical OLTP application would be a database of online purchases. Each purchase is inserted into the database.
- OLTP is not computationally intensive.
- OLAP vs. OLTP.